Lowell Regional Wastewater
451 First Street Boulevard
Lowell, MA 01854
Attn: Aaron Fox

January 29, 2020

Dear Mr. Fox,

Enclosed please find the toxicological evaluation and chemical analyses report for the effluent sample received on January 13, 2020. This is your first quarter 2020 bioassay. Please call me at (401) 353-3420 if you have any questions.

Sincerely,

Michael McCallum
Technical Laboratory Director

TOXICOLOGICAL EVALUATION AND CHEMICAL ANALYSES OF EFFLUENT:
NPDES Permit # MA0100633
First Quarter 2020 Samples
Lowell Regional Wastewater

Prepared For:
Lowell Regional Wastewater
451 First Street Boulevard
Lowell, MA 01854

January 29, 2020

By
New England Testing Laboratory, Inc.
59 Greenhill Street
West Warwick, RI 02893

NETLAB CASE NUMBER: 0A13003

New England Bioassay
A Division of GZA

GEOTECHNICAL
ENVIRONMENTAL
ECOLOGICAL
WATER
CONSTRUCTION MANAGEMENT

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NEW ENGLAND BIOASSAY A DIVISION OF GZA
CHRONIC AQUATIC TOXICITY TEST REPORT

Permitee: Lowell RWWU NPDES # MA0100633
Report submitted to: New England Testing Laboratories
59 Greenhill Street, West Warwick RI
Sample ID: Effluent
Test Month/Year: January 2020
NEB Proj # 05.0044476.00

Test Type / Method: *Ceriodaphnia dubia* Modified Chronic Static-Renewal Freshwater Test Method 1002.0; EPA 821-R-02-013

Effluent Sample Dates: #1 1/12-13/20 #2 1/14-15/20 #3 1/16-17/20

Test Start Date: 1/14/20

Results Summary

Your results were as follows:

Passed all permit limits

Acute Test Results

Species	LC50	A-NOEC	Permit Limit	Pass / Fail
Ceriodaphnia dubia	>100%	100%	≥ 100%	Pass

Chronic Test Results

Species	C-NOEC	C-LOEC	IC25	Permit Limit	Pass/Fail
Ceriodaphnia dubia	100%	>100%	>100%	N/A	N/A

Data Qualifiers affecting this test:

Certifications & Approvals: NH ELAP (2071), NJ DEP (CT405)

Test Report Certification

Permittee name:	Lowell RWWU	Permit number:	MA0100633
Client sample ID:	Effluent	Test Start Date:	1/14/20

Whole Effluent Toxicity Test Report Certification (Permittee)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on: _____ (Date)

_____ Authorized Signature

_____ Print or Type Name and Title

_____ Print or Type the Permittee's Name

MA0100633
Print or Type the NPDES Permit Number

Whole Effluent Toxicity Test Report Certification (Bioassay Laboratory)

The results reported relate only to the samples submitted as received

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on: 1/29/20 (Date)

Kimberly Wills
Laboratory Manager
New England Bioassay a division of GZA

General Test Conditions

Permittee name: Lowell RWWU | Permit number: MA0100633

Client sample ID: Effluent | Test Start Date: 1/14/20

Sample Collection Information

Effluent #1 Dates/Times: 1/12-13/20 @ 0700-0700 Receiving Water #1 Date/Time: 1/13/20 @ 0800

Effluent #2 Dates/Times: 1/14-15/20 @ 0700-0700 Receiving Water #2 Date/Time: 1/15/20 @ 0800

Effluent #3 Dates/Times: 1/16-17/20 @ 0700-0700 Receiving Water #3 Date/Time: 1/17/20 @ 0800

Were a minimum of three samples collected? Yes ☑ No ☐ *(see note below)

Were samples used within the first 36 hours of collection? Yes ☑ No ☐ * (see note below)

* sample collection note:

Test Conditions

Permittee's Receiving Water: Merrimack River

- Dilution water: Laboratory synthetic soft water (hardness 45 - 55 mg/L CaCO3)
- Control water: Receiving water collected at a point immediately upstream of or away from the discharge

Effluent concentrations tested: 0%, 6.25%, 12.5%, 25%, 50%, 100%

Was effluent salinity adjusted? No ☑ Yes ☐ with Instant Ocean sea salts to _____ ppt

Dechlorination procedures: Chlorine is measured using 4500 CL-G DPD Colorimetric Method

- Dechlorination was not required

TRC results and further information about aeration of samples can be found attached in "sample receipt chemistry"

Reference Toxicant Data

Ceriodaphnia dubia

Date:	1/2/20
Toxicant:	Sodium chloride
Dilution Water:	NEB CTRMH
Organism Source:	NEB
Reproduction IC25:	1.11 g/L
Results within range	Yes ☑ No ☐

Ceriodaphnia dubia Test Results

Permittee name: Lowell RWWU Permit number: MA0100633

Client sample ID: Effluent Test Dates: 1/14/20 - 1/20/20

Test Acceptability Criteria

Lab Diluent Survival:	100 %	Mean Lab Diluent Reproduction:	30.5 young per female
River Control Survival:	100 %	Mean River Control Reproduction:	33.5 young per female
Thiosulfate Control Survival:	N/A %	Mean Thiosulfate Control Reproduction:	N/A young per female

Presence of an asterisk (*) indicates EPA criteria was not met, see explanation in the "Results Discussion" section at the bottom of the following page.

Test Results

		Permit Limit	Test Result	Pass/Fail Status
Acute Data	48 hr LC50	≥ 100%	>100%	Pass
	48 hr NOEC		100%	
	TUa			
Chronic Data	Chronic LC50		>100%	
	Survival C-NOEC		100%	
	Survival C-LOEC		>100%	
	Reproduction C-NOEC		100%	
	Reproduction C-LOEC		>100%	
	Reproduction IC25		>100%	
	Reproduction IC50		>100%	
	Reportable C-NOEC		100%	
	Reportable C-LOEC		>100%	
	MATC		>100%	
	TUc			

Presence of an asterisk (*) indicates qualified data, see explanation in the "Results Discussion" section at the bottom of the following page.

Test Variability

Reproduction PMSD: 23.7% Upper & Lower EPA bounds: 13 - 47% ☐ Low ☑ Within bounds ☐ High

☐ PMSD exceeds upper bounds. Test results are highly variable and may not be sensitive enough to determine the presence of toxicity at the permit limit concentration (PLC)

☑ The PMSD falls within the upper (47%) and lower (13%) bounds. Results are reportable.

☐ PMSD falls below the lower bound test variability criterion. The test is very sensitive. The relative percent difference (RPD) between the control and each treatment was calculated and compared to the lower bound.

- ☐ The RPD values for all concentrations fall below the lower bound. Any differences observed in this test are considered statistically insignificant.
- ☐ Some of the concentrations that were flagged as statistically significant have RPD values that fall below the lower bound. Any differences observed in these concentrations will not be considered statistically significantly decreased from the control.
- ☐ No statistically significant reductions were observed in this test.

Ceriodaphnia dubia Test Results

Permittee name: Lowell RWWU Permit number: MA0100633

Client sample ID: Effluent Test Dates: 1/14/20 - 1/20/20

Concentration - Response Evaluation

Survival: #11 No concentration-response curve: no mortality observed at any concentration.

Reproduction: #12 No significant effects at any test concentration with a relatively flat concentration-response curve. Test concentrations performed both above and below (but similarly to) the dilution control.

The concentration - response relationship was reviewed and the following determination was made:

Survival	Reproduction	
X	X	Results are reliable and reportable
		Results are anomalous (see explanation below)
		Results are inconclusive - retest (see explanation below)

Results Discussion (if applicable):

TEST METHODS

Ceriodaphnia dubia

Test type:	Modified Chronic Static Renewal Freshwater Test
Test Reference Manual:	EPA-821-R-02-013 "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms"
Test Method:	*Ceriodaphnia dubia* Survival and Reproduction Test - EPA 1002.0
Temperature:	25 ˚C ± 1˚C (Temperatures should not deviate by more than 3˚C during the test) (required)
Light Quality:	Ambient Laboratory Illumination (recommended)
Light Intensity:	10-20 µE/m2/s, or 50-100 ft-c (recommended)
Photoperiod:	16 hours light, 8 hours dark (recommended)
Test chamber size:	30 mL (recommended minimum)
Test solution volume:	15 mL (recommended minimum)
Renewal of Test Solutions:	Daily (required)
Age of Test Organisms:	Less than 24 hours; and all released within a 8-h period (required)
Number of Neonates Per Test Chamber:	1 Assigned using blocking by known parentage (required)
Number of Replicate Test Chambers Per Treatment:	10 (required minimum)
Number of Neonates Per Test Concentration:	10 (required minimum)
Feeding Regime:	Fed 0.1 mL each of YCT and algal suspension per exposure chamber daily. (recommended)
Cleaning:	Use new plastic cups daily (recommended)
Aeration:	None (recommended)
Test Duration:	Until 60% or more of control females have three broods (maximum test duration 8 days) (required)
Endpoints:	Survival and reproduction (required)
Test Acceptability:	80% or greater survival of all control organisms and an average of 15 or more young per surviving female in the control solutions. 60% of surviving control females must produce three broods. (required)
Sampling Requirements:	Minimum of three samples with a maximum holding time of 36 hours before first use. (required)
Sample volume required:	1 L/Day (recommended)

CERIODAPHNIA DUBIA
DATASHEETS & STATISTICAL ANALYSIS

NEW ENGLAND BIOASSAY TOXICITY DATA FORM
CHRONIC COVER SHEET

CLIENT:	New England Testing Laboratories	*C.dubia* TEST ID #	20-55
ADDRESS:	59 Greenhill Street	CHAIN OF CUSTODY #	C40/1115/16
	West Warwick, RI 02893	NEB PROJECT #	05.0044476.00
PERMITTEE:	Lowell RWWU	SAMPLE ID:	Effluent
PERMIT NUMBER:	MA0100633		
DILUTION WATER:	Laboratory Soft Water		

INVERTEBRATES

TEST SET-UP TECHNICIAN:	PD
TEST SPECIES:	*Ceriodaphnia dubia*
NEB LOT #	Cd20(RMH 005)
AGE:	< 24 hours
TEST SOLUTION VOLUME (mls):	15
ORGANISMS PER TEST CHAMBER:	1
ORGANISMS PER CONCENTRATION:	10

LABORATORY CONTROL WATER (SRCF)

Lot Number	Hardness mg/L $CaCO_3$	Alkalinity mg/L $CaCO_3$
C40-S001	46	35

	DATE	TIME
TEST START:	1/14/20	1145
TEST END:	1/20/20	1214

COMMENTS: _____

REVIEWED BY: _____ DATE: 1/29/20

NEW ENGLAND BIOASSAY - CHRONIC TOXICITY TEST BROOD DATA SHEET

FACILITY NAME & ADDRESS:	Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850				
NEB PROJECT NUMBER:	05.0044476.00	NEB TEST NUMBER:	20-55	COC #	C40/1115/16
TEST ORGANISM:	*Ceriodaphnia dubia*	AGE:	<24 hours	Lot #	Cd20(RMH 005)
START DATE:	1/14/20	TIME:	1145	END DATE:	1/20/20	TIME:	1214

Effluent Concentration	Day Number	Culture Lot# Cd20(RMH 005) Cup # / Replicate										Total Live Young	# Live Adults	Analyst-Transfer	Analyst-Counts
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10				
		A	B	C	D	E	F	G	H	I	J				
NEB Lab Synthetic Diluent	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	PD	
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	CW	
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	KO	
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	CW	CW
	4	6	4	4	6	5	4	6	6	8	7	56	10	CW	CW
	5	8	10	12	13	9	12	12	10	10	11	107	10	CW	CW
	6	10	15	16	16	12	16	12	16	16	13	142	10	CH	CH
	7														
	totals	24	29	32	35	26	32	30	32	34	31	305	10		MC
		A	B	C	D	E	F	G	H	I	J				
Merrimack River Control	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	4	7	7	7	6	7	6	5	6	6	9	66	10		
	5	14	14	15	10	16	8	10	13	15	14	129	10		
	6	13	20	14	17	9	✓	19	15	14	19	140	10		
	7														
	totals	34	41	36	33	32	14	34	34	35	42	335	10		
		A	B	C	D	E	F	G	H	I	J				
6.25%	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	4	5	6	5	6	7	6	7	5	8	8	63	10		
	5	8	10	13	13	16	10	14	13	15	15	127	10		
	6	5	17	12	2	8	✓	12	12	8	11	87	10		
	7														
	totals	18	33	30	21	31	16	33	30	31	34	277	10		

Notes: _____

NEW ENGLAND BIOASSAY - CHRONIC TOXICITY TEST BROOD DATA SHEET

FACILITY NAME & ADDRESS:	Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850		
NEB PROJECT NUMBER: 05.0044476.00	ORGANISM: *Ceriodaphnia dubia*	START DATE: 1/14/20	

Effluent Concentration	Day Number	Replicate A	B	C	D	E	F	G	H	I	J	Total Live Young	# Live Adults		
12.5%	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	4	6	5	8	6	8	5	7	5	6	7	63	10		
	5	11	9	2	13	3	16	14	9	14	12	103	10		
	6	15	16	1	20	2	16	19	16	2	17	124	10		
	7														
	totals	32	30	11	39	13	37	40	30	22	36	290	10		
		A	B	C	D	E	F	G	H	I	J				
25%	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	4	5	✓	5	6	8	7	3	6	7	✓	47	10		
	5	10	13	10	13	12	11	12	12	12	12	117	10		
	6	11	8	6	19	11	15	15	19	18	✓	122	10		
	7														
	totals	26	21	21	38	31	33	30	37	37	12	286	10		
		A	B	C	D	E	F	G	H	I	J				
50%	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	4	4	7	5	4	8	6	5	5	7	6	57	10		
	5	10	14	13	12	12	13	12	13	15	15	129	10		
	6	14	17	16	✓	19	17	18	12	16	18	147	10		
	7														
	totals	28	38	34	16	39	36	35	30	38	39	333	10		
		A	B	C	D	E	F	G	H	I	J				
100%	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	4	6	6	7	5	6	8	7	5	6	✓	56	10		
	5	16	12	14	10	12	12	10	12	14	10	122	10		
	6	13	16	13	17	16	12	14	15	13	13	142	10		
	7														
	totals	35	34	34	32	34	32	31	32	33	23	320	10		

Ceriodaphnia 7-d Survival and Reproduction Test — **New England Bioassay**

Analysis ID:	07-5652-9654	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.4		
Analyzed:	21 Jan-20 10:03	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1		
Batch ID:	04-6623-7566	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**			
Start Date:	14 Jan-20 11:45	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Laboratory Water		
Ending Date:	20 Jan-20 12:14	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable		
Test Length:	6d 0h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture	**Age:**	<24
Sample ID:	05-0947-0498	**Code:**	1E5DE722	**Project:**			
Sample Date:	13 Jan-20 07:00	**Material:**	WWTF Effluent	**Source:**	Lowell RWWU (MA0100633)		
Receipt Date:	13 Jan-20 15:10	**CAS (PC):**		**Station:**			
Sample Age:	29h	**Client:**	New England Testing Labs				

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X)	Linear	1615663	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC50	>100	n/a	n/a	<1	n/a	n/a

2d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	**Code**	**Count**	**Mean**	**Min**	**Max**	**Std Dev**	**CV%**	**%Effect**	**A/B**	**Mean**	**%Effect**
0	D	10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

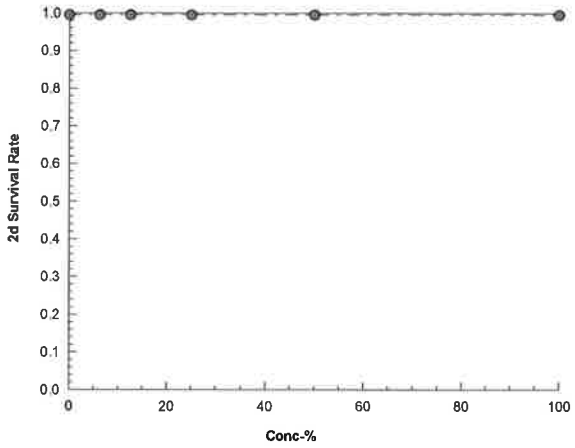
2d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test | **New England Bioassay**

Analysis ID:	07-5652-9654	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	21 Jan-20 10:03	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **New England Bioassay**

Analysis ID:	09-5853-8932	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	21 Jan-20 10:03	**Analysis:**	STP 2xK Contingency Tables	**Status Level:**	1
Batch ID:	04-6623-7566	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	14 Jan-20 11:45	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Laboratory Water
Ending Date:	20 Jan-20 12:14	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Test Length:	6d 0h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24
Sample ID:	05-0947-0498	**Code:**	1E5DE722	**Project:**	
Sample Date:	13 Jan-20 07:00	**Material:**	WWTF Effluent	**Source:**	Lowell RWWU (MA0100633)
Receipt Date:	13 Jan-20 15:10	**CAS (PC):**		**Station:**	
Sample Age:	29h	**Client:**	New England Testing Labs		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	100	>100	n/a	1

Fisher Exact/Bonferroni-Holm Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Dilution Water		6.25	1.0000	Exact	1.0000	Non-Significant Effect
		12.5	1.0000	Exact	1.0000	Non-Significant Effect
		25	1.0000	Exact	1.0000	Non-Significant Effect
		50	1.0000	Exact	1.0000	Non-Significant Effect
		100	1.0000	Exact	1.0000	Non-Significant Effect

Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	D	10	0	10	1	0	0.0%
6.25		10	0	10	1	0	0.0%
12.5		10	0	10	1	0	0.0%
25		10	0	10	1	0	0.0%
50		10	0	10	1	0	0.0%
100		10	0	10	1	0	0.0%

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

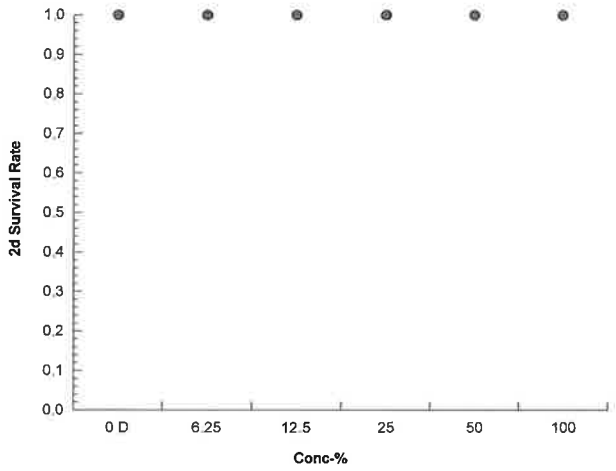
2d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test | **New England Bioassay**

Analysis ID:	09-5853-8932	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	21 Jan-20 10:03	**Analysis:**	STP 2xK Contingency Tables	**Status Level:**	1

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **New England Bioassay**

Analysis ID:	19-2039-5676	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	21 Jan-20 10:03	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Batch ID:	04-6623-7566	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	14 Jan-20 11:45	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Laboratory Water
Ending Date:	20 Jan-20 12:14	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Test Length:	6d 0h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24
Sample ID:	05-0947-0498	**Code:**	1E5DE722	**Project:**	
Sample Date:	13 Jan-20 07:00	**Material:**	WWTF Effluent	**Source:**	Lowell RWWU (MA0100633)
Receipt Date:	13 Jan-20 15:10	**CAS (PC):**		**Station:**	
Sample Age:	29h	**Client:**	New England Testing Labs		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X)	Linear	577227	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
LC50	>100	n/a	n/a	<1	n/a	n/a

6d Survival Rate Summary

			Calculated Variate(A/B)							Isotonic Variate	
Conc-%	**Code**	**Count**	**Mean**	**Min**	**Max**	**Std Dev**	**CV%**	**%Effect**	**A/B**	**Mean**	**%Effect**
0	D	10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%

6d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

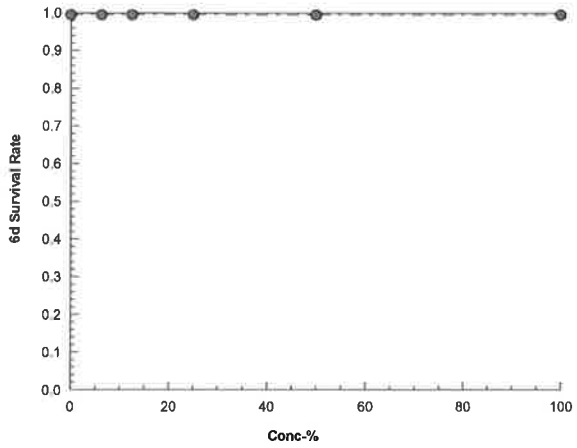
6d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test **New England Bioassay**

Analysis ID:	19-2039-5676	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	21 Jan-20 10:03	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **New England Bioassay**

Analysis ID:	18-2195-9980	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	21 Jan-20 10:03	**Analysis:**	STP 2xK Contingency Tables	**Status Level:**	1
Batch ID:	04-6623-7566	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	14 Jan-20 11:45	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Laboratory Water
Ending Date:	20 Jan-20 12:14	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Test Length:	6d 0h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24
Sample ID:	05-0947-0498	**Code:**	1E5DE722	**Project:**	
Sample Date:	13 Jan-20 07:00	**Material:**	WWTF Effluent	**Source:**	Lowell RWWU (MA0100633)
Receipt Date:	13 Jan-20 15:10	**CAS (PC):**		**Station:**	
Sample Age:	29h	**Client:**	New England Testing Labs		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	100	>100	n/a	1

Fisher Exact/Bonferroni-Holm Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Dilution Water		6.25	1.0000	Exact	1.0000	Non-Significant Effect
		12.5	1.0000	Exact	1.0000	Non-Significant Effect
		25	1.0000	Exact	1.0000	Non-Significant Effect
		50	1.0000	Exact	1.0000	Non-Significant Effect
		100	1.0000	Exact	1.0000	Non-Significant Effect

Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	D	10	0	10	1	0	0.0%
6.25		10	0	10	1	0	0.0%
12.5		10	0	10	1	0	0.0%
25		10	0	10	1	0	0.0%
50		10	0	10	1	0	0.0%
100		10	0	10	1	0	0.0%

6d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

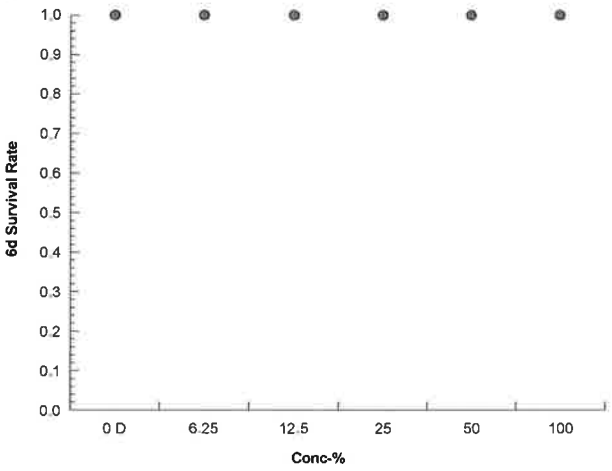
6d Survival Rate Binomials

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test | **New England Bioassay**

Analysis ID:	18-2195-9980	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	21 Jan-20 10:03	**Analysis:**	STP 2xK Contingency Tables	**Status Level:**	1

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **New England Bioassay**

Analysis ID:	17-8520-9442	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.4
Analyzed:	21 Jan-20 10:03	**Analysis:**	Nonparametric-Control vs Treatments	**Status Level:**	1
Batch ID:	04-6623-7566	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	14 Jan-20 11:45	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Laboratory Water
Ending Date:	20 Jan-20 12:14	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Test Length:	6d 0h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24
Sample ID:	05-0947-0498	**Code:**	1E5DE722	**Project:**	
Sample Date:	13 Jan-20 07:00	**Material:**	WWTF Effluent	**Source:**	Lowell RWWU (MA0100633)
Receipt Date:	13 Jan-20 15:10	**CAS (PC):**		**Station:**	
Sample Age:	29h	**Client:**	New England Testing Labs		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	100	>100	n/a	1	23.73%

Steel Many-One Rank Sum Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Dilution Water		6.25	95.5	75	3	18	Asymp	0.5455	Non-Significant Effect
		12.5	108.5	75	2	18	Asymp	0.9005	Non-Significant Effect
		25	102.5	75	3	18	Asymp	0.7709	Non-Significant Effect
		50	128.5	75	3	18	Asymp	0.9991	Non-Significant Effect
		100	122	75	4	18	Asymp	0.9941	Non-Significant Effect

Test Acceptability Criteria

		TAC Limits			
Attribute	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
Control Resp	30.5	15	>>	Yes	Passes Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	231.883	46.3767	5	0.9278	0.4703	Non-Significant Effect
Error	2699.1	49.9833	54			
Total	2930.98		59			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	16.1	15.09	0.0066	Unequal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9112	0.9459	3.5E-04	Non-Normal Distribution

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	D	10	30.5	28.06	32.94	31.5	24	35	1.078	11.17%	0.00%
6.25		10	27.7	22.91	32.49	30.5	16	34	2.119	24.19%	9.18%
12.5		10	29	21.56	36.44	31	11	40	3.29	35.87%	4.92%
25		10	28.6	22.5	34.7	30.5	12	38	2.696	29.81%	6.23%
50		10	33.3	28.2	38.4	35.5	16	39	2.256	21.42%	-9.18%
100		10	32	29.57	34.43	32.5	23	35	1.075	10.62%	-4.92%

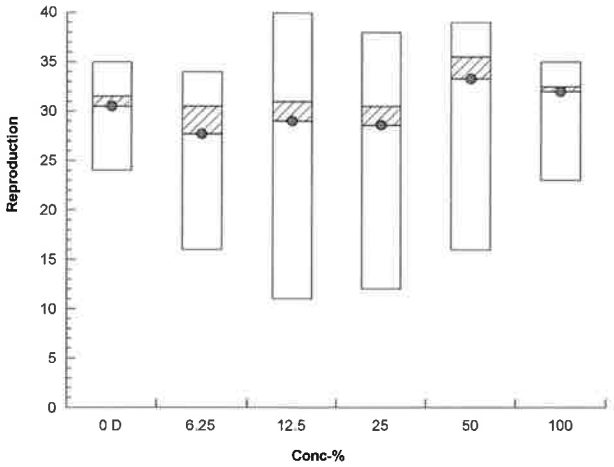
Reproduction Detail

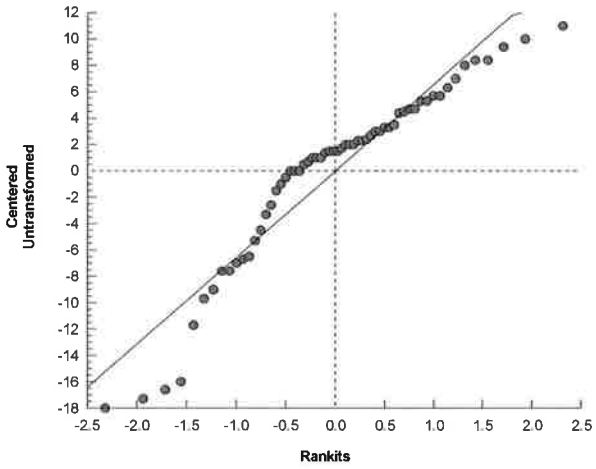
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	24	29	32	35	26	32	30	32	34	31
6.25		18	33	30	21	31	16	33	30	31	34
12.5		32	30	11	39	13	37	40	30	22	36
25		26	21	21	38	31	33	30	37	37	12
50		28	38	34	16	39	36	35	30	38	39
100		35	34	34	32	34	32	31	32	33	23

Ceriodaphnia 7-d Survival and Reproduction Test | **New England Bioassay**

Analysis ID:	17-8520-9442	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.4
Analyzed:	21 Jan-20 10:03	**Analysis:**	Nonparametric-Control vs Treatments	**Status Level:**	1

Graphics





Ceriodaphnia 7-d Survival and Reproduction Test — **New England Bioassay**

Analysis ID:	16-3497-5334	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.4
Analyzed:	21 Jan-20 10:03	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Batch ID:	04-6623-7566	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	14 Jan-20 11:45	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Laboratory Water
Ending Date:	20 Jan-20 12:14	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Test Length:	6d 0h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24
Sample ID:	05-0947-0498	**Code:**	1E5DE722	**Project:**	
Sample Date:	13 Jan-20 07:00	**Material:**	WWTF Effluent	**Source:**	Lowell RWWU (MA0100633)
Receipt Date:	13 Jan-20 15:10	**CAS (PC):**		**Station:**	
Sample Age:	29h	**Client:**	New England Testing Labs		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	1907160	200	Yes	Two-Point Interpolation

Test Acceptability Criteria

		TAC Limits			
Attribute	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
Control Resp	30.5	15	>>	Yes	Passes Criteria

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC25	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

Reproduction Summary

			Calculated Variate						Isotonic Variate	
Conc-%	**Code**	**Count**	**Mean**	**Min**	**Max**	**Std Dev**	**CV%**	**%Effect**	**Mean**	**%Effect**
0	D	10	30.5	24	35	3.408	11.17%	0.0%	30.5	0.0%
6.25		10	27.7	16	34	6.701	24.19%	9.18%	30.12	1.25%
12.5		10	29	11	40	10.4	35.87%	4.92%	30.12	1.25%
25		10	28.6	12	38	8.527	29.81%	6.23%	30.12	1.25%
50		10	33.3	16	39	7.134	21.42%	-9.18%	30.12	1.25%
100		10	32	23	35	3.399	10.62%	-4.92%	30.12	1.25%

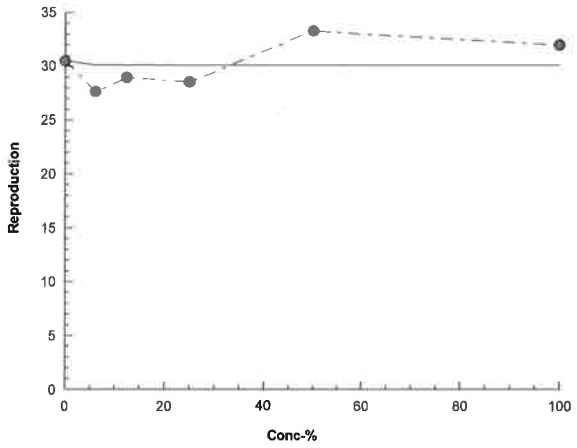
Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	24	29	32	35	26	32	30	32	34	31
6.25		18	33	30	21	31	16	33	30	31	34
12.5		32	30	11	39	13	37	40	30	22	36
25		26	21	21	38	31	33	30	37	37	12
50		28	38	34	16	39	36	35	30	38	39
100		35	34	34	32	34	32	31	32	33	23

Ceriodaphnia 7-d Survival and Reproduction Test **New England Bioassay**

Analysis ID:	16-3497-5334	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.4
Analyzed:	21 Jan-20 10:03	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1

Graphics



NEB'S DATA SHEET FOR ROUTINE CHEMICAL AND PHYSICAL DETERMINATIONS

FACILITY NAME & ADDRESS:	Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850							
NEB PROJECT NUMBER:	05.0044476.00			TEST ORGANISM			*Ceriodaphnia dubia*	
DILUTION WATER SOURCE:	Laboratory Soft Water			START DATE:			1/14/20 TIME:	1145
ANALYST	PD	CH	KO	CW	KW	KW		
NEB Lab Diluent	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.1	24.8	24.7	24.1	24.9	24.7		
D.O. mg/L Initial	8.5	8.3	8.2	8.5	8.7	8.4		
pH s.u. Initial	7.4	7.5	7.4	7.5	7.3	7.4		
Conductivity µS Initial	176	178	178	178	176	176		
Temp °C Final	24.3	24.0	24.0	24.0	25.6	24.3		
D.O. mg/L Final	8.1	8.4	8.6	8.3	7.9	8.0		
pH s.u. Final	7.9	7.7	7.8	8.0	7.5	7.4		
Conductivity µS Final	205	193	190	199	207	207		
Merrimack River Control	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.7	24.9	24.7	24.2	25.0	25.0		
D.O. mg/L Initial	9.7	8.9	8.2	8.8	8.5	8.7		
pH s.u. Initial	7.3	7.5	7.5	7.4	7.4	7.4		
Conductivity µS Initial	166	167	122	123	125	125		
Temp °C Final	24.4	24.0	24.0	24.0	25.6	24.3		
D.O. mg/L Final	8.1	8.1	8.5	8.3	7.9	8.0		
pH s.u. Final	7.9	7.7	7.7	7.9	7.4	7.4		
Conductivity µS Final	184	175	*NR	154	153	152		*NR: not recorded
6.25%	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.6	25.0	25.1	24.1	25.0	24.5		
D.O. mg/L Initial	8.5	8.3	9.0	8.6	9.2	8.8		
pH s.u. Initial	7.5	7.4	7.4	7.4	7.3	7.4		
Conductivity µS Initial	234	239	233	231	268	271		
Temp °C Final	24.4	24.0	24.1	24.0	25.6	24.4		
D.O. mg/L Final	8.2	8.1	8.3	8.2	7.8	8.1		
pH s.u. Final	7.7	7.6	7.6	7.8	7.4	7.4		
Conductivity µS Final	255	247	247	258	302	302		
12.5%	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.6	25.0	25.0	24.1	25.4	25.1		
D.O. mg/L Initial	8.4	8.2	8.6	8.5	8.7	8.4		
pH s.u. Initial	7.6	7.5	7.4	7.4	7.3	7.4		
Conductivity µS Initial	309	306	290	289	368	374		
Temp °C Final	24.5	24.0	24.0	24.0	25.5	24.5		
D.O. mg/L Final	8.2	8.2	8.5	8.3	7.9	8.1		
pH s.u. Final	7.7	7.6	7.6	7.7	7.6	7.5		
Conductivity µS Final	330	316	305	304	394	407		

NEB'S DATA SHEET FOR ROUTINE CHEMICAL AND PHYSICAL DETERMINATIONS

FACILITY NAME & ADDRESS:	Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850							
NEB PROJECT NUMBER:	05.0044476.00			TEST ORGANISM		*Ceriodaphnia dubia*		
DILUTION WATER SOURCE:	Laboratory Soft Water			START DATE:		1/14/20	TIME:	1145
25%	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.6	25.0	24.9	24.1	25.4	25.1		
D.O. mg/L Initial	8.5	8.2	8.3	8.4	8.6	8.3		
pH s.u. Initial	7.6	7.5	7.4	7.5	7.3	7.5		
Conductivity µS Initial	430	432	419	402	564	560		
Temp °C Final	24.4	24.0	24.0	24.0	25.6	24.5		
D.O. mg/L Final	8.2	8.2	8.4	8.3	7.9	8.1		
pH s.u. Final	7.7	7.7	7.6	7.7	7.7	7.6		
Conductivity µS Final	458	445	437	440	599	619		
50%	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.6	24.9	24.8	24.1	25.3	24.8		
D.O. mg/L Initial	8.6	8.3	8.4	8.4	8.7	8.5		
pH s.u. Initial	7.5	7.5	7.4	7.6	7.3	7.4		
Conductivity µS Initial	685	691	606	628	954	945		
Temp °C Final	24.4	24.0	24.0	24.0	25.6	24.5		
D.O. mg/L Final	8.2	8.3	8.3	8.3	7.9	8.1		
pH s.u. Final	7.8	7.8	7.7	7.8	7.8	7.7		
Conductivity µS Final	751	704	634	690	1,097	1,128		
100%	1	2	3	4	5	6	7	Remarks
Temp °C Initial	25.5	24.9	24.6	24.0	25.1	24.8		
D.O. mg/L Initial	9.1	8.4	8.5	8.5	9.2	8.5		
pH s.u. Initial	7.4	7.5	7.4	7.6	7.2	7.4		
Conductivity µS Initial	1,203	1,216	1,069	1,080	1,727	1,730		
Temp °C Final	24.4	24.0	24.0	24.0	25.6	24.6		
D.O. mg/L Final	8.2	8.2	8.3	8.3	7.9	8.1		
pH s.u. Final	7.9	8.0	7.9	7.9	8.0	8.0		
Conductivity µS Final	1,244	1,219	1,092	1,148	1,836	1,850		

Table of Random Permutations of 16 **C.dubia Test ID#** 20-55

7	12	15	15	1	2	7	16	10	2	14	15	7	13	13	10	6	1	8	10
13	3	8	16	7	10	11	10	13	5	11	7	13	16	7	7	5	13	2	14
3	1	4	5	14	13	3	14	9	13	13	2	9	15	6	2	8	4	5	8
11	8	16	14	15	6	2	6	2	16	8	5	12	3	9	13	4	3	10	4
14	9	1	6	3	9	14	13	8	6	5	8	14	7	3	15	13	11	4	7
2	16	10	13	5	5	13	2	11	7	3	12	5	14	12	16	2	2	9	15
4	6	13	7	2	15	1	9	1	4	7	10	6	9	11	9	7	6	16	11
6	14	6	10	4	14	4	15	3	3	4	16	2	6	5	1	12	10	6	9
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15	7	5	2	10	7	8	12	6	15	6	13	16	12	15	4	11	8	12	6
16	2	11	8	8	8	15	5	16	1	1	9	8	1	8	14	16	5	13	5
9	13	14	3	6	4	10	11	5	12	9	3	10	4	4	3	10	9	1	3
8	11	9	4	11	3	12	7	7	10	12	14	3	10	1	6	15	16	15	12
1	5	12	11	16	16	5	4	14	9	16	11	1	2	10	5	1	15	7	13
5	4	3	9	12	1	6	1	15	11	2	6	4	11	2	11	3	7	11	16
							conc							reps					
11	8	16	5	5	13	1	13	2	16	14	12	9	8	7	5	13	3	13	3
2	2	8	8	14	16	4	3	8	11	10	14	15	1	2	11	4	5	15	9
6	13	2	13	6	5	9	15	11	10	12	6	16	15	16	9	10	12	16	15
14	12	4	16	16	11	14	10	5	12	3	3	12	14	15	13	6	4	1	16
8	6	3	9	4	10	6	4	16	2	2	9	8	16	4	6	5	15	7	8
9	15	12	10	3	2	12	6	1	15	4	13	7	7	9	12	14	8	8	11
3	10	11	12	13	12	5	11	7	8	9	5	14	11	10	1	3	13	3	5
16	1	13	14	8	14	15	5	3	7	11	15	6	12	5	7	11	1	14	4
1	14	14	2	9	15	16	14	6	14	7	8	3	13	11	8	7	7	12	7
4	4	6	4	12	3	11	8	15	9	8	1	13	6	3	3	15	9	9	12
15	5	1	11	10	6	3	7	10	5	5	11	10	10	12	15	16	14	5	2
5	3	5	6	7	7	13	2	14	3	16	4	5	5	13	4	9	16	2	6
12	7	15	15	15	9	8	12	12	13	15	10	1	4	6	16	2	6	11	1
10	11	10	3	2	4	2	1	4	6	6	7	11	9	14	10	8	11	4	13
7	9	7	7	11	1	7	16	13	1	13	2	4	2	1	2	12	2	10	14
13	16	9	1	1	8	10	9	9	4	1	16	2	3	8	14	1	10	6	10
1	6	7	4	8	6	5	2	8	15	4	6	6	1	4	5	7	13	2	10
9	15	11	3	11	15	9	10	1	3	8	2	15	7	9	8	16	1	14	3
10	16	4	5	12	9	16	11	7	1	7	16	11	8	3	3	12	2	3	4
4	14	1	9	5	5	4	13	6	8	15	5	12	5	7	16	5	11	8	1
7	3	13	14	15	2	1	14	16	5	14	9	2	16	1	12	6	14	4	13
16	11	2	1	14	16	6	9	3	4	16	14	3	15	11	11	3	9	12	5
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13	12	5	11	3	11	15	8	2	7	11	7	8	14	6	4	4	4	15	11
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8	9	8	10	6	4	11	7	10	11	6	8	4	9	8	15	8	6	11	9
2	7	6	2	1	8	10	6	15	12	1	11	7	11	13	6	1	15	13	15
6	4	15	8	16	10	14	16	9	6	12	3	10	6	14	7	2	12	16	7
5	8	12	15	7	3	12	5	12	9	5	15	1	13	15	13	15	5	1	2
13	4	10	4	16	13	16	13	5	3	6	14	1	16	8	7	2	3	3	12
5	14	4	6	8	2	15	1	13	14	16	4	15	4	3	12	12	1	4	7
2	2	2	15	14	16	9	12	16	6	10	15	14	9	10	1	14	8	8	16
7	12	15	8	12	3	5	14	7	12	5	13	16	1	7	5	11	2	9	3
6	9	7	14	9	14	10	11	15	11	12	1	12	12	14	16	3	11	11	8
14	5	16	7	10	8	11	8	14	13	7	11	6	3	11	4	4	6	6	9
15	11	8	9	7	12	8	7	1	15	9	3	3	7	13	11	10	4	5	1
11	6	6	1	4	1	3	16	12	5	4	9	13	13	6	8	15	9	1	14
4	10	3	16	2	11	7	9	6	9	1	8	4	11	5	2	16	10	12	4
1	8	1	13	1	15	4	4	11	4	2	16	5	8	1	9	5	12	16	6
9	7	14	2	6	4	14	10	9	8	15	10	7	10	9	10	6	14	10	11
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10	15	11	5	13	7	12	5	2	7	11	5	10	15	12	3	1	13	13	10
8	13	13	3	3	10	13	2	4	1	8	6	11	14	15	6	9	16	2	2
16	16	5	12	11	6	1	3	8	16	3	7	2	5	16	14	13	7	14	15

Ceriodaphnia dubia Culture Chart

Lot # Cd20 (RMH 005) A

Brood mother source: RMH 309 B-5 Source's brood size: 18 (Qty.)

Lowell 1-14-20

Tech	AH	KF	AH	AH	AH		MC	AH		AH						
Date	1-6	1-7	1-8	1-9	1-10		1-12	1-13		1-14						
Day acc.	0	1	2	3	4	5	6	7		8	9	10	11	12	13	14
Cup # 1	N	N	N	N	6		15	Y	1	T1 Y 24						
2	N	N	N	N	6		14	Y	2	T2 Y 24						
3	N	N	N	N	5		14	Y	3	T3 Y 21						
4	N	N	N	N	5		14	Y	4	T4 Y 22						
5	N	N	N	N	6		12	Y	5	T5 Y 20						
6	N	N	N	N	5		9	Y	6	T6 Y 27						
7	N	N	N	N	8		13	Y	7	T7 Y 24						
8	N	N	N	N	7		15	Y	8	T8 Y 24						
9	N	N	N	N	8		15	Y	9	T9 Y 21						
10	N	N	N	N	7		17	Y	10	T10 Y 24						
11	N	N	N	N	6		16	Y	11	Y						
12	N	N	N	N	7		15	Y	12	Y						
13	N	N	N	N	6		16	Y	13	Y						

Y = neonates present, and *criterion has been met:* ≥ 20 neonates produced in total by 3rd brood. **N** = no neonates

2B = two broods present. **2Y** = two broods and criterion met: ≥ 20 neos. by 3rd brood. **X** = brood mother dead **ae** = aborted eggs

✓ or **P** = neonates present after renewal on previous day (see time in log). **A→** = acceptable for acute testing only

T# = neonates used in test, replicate number of test noted (and brood counted). **acc.** = *if acclimated*, H_2O type used w/ renewal **this** day.

Test organism collection:

Project #	Symbols (✓ / P)	Tray diagram used? (Y/N)	Time period, neonates released	Collection date / time
0044476	T	Y	1-13-20/1630 → 1-13-20/2120	1-14-20/1000
046099	T	Y	1-13-20/1630 → 1-13-20/2120	1-14-2/1245
	T			
	T			
	T			
	T			

SAMPLE RECEIPT CHEMISTRY
&
CHAIN OF CUSTODY DOCUMENTS

NEW ENGLAND BIOASSAY - INITIAL CHEMISTRY DATA

PERMITTEE: Lowell RWWU

NEB JOB # 05.0044476.00

DATE RECEIVED	1/13/20		1/15/20		1/17/20	
SAMPLE TYPE:	EFF #1	RIVER #1	EFF #2	RIVER #2	EFF #3	RIVER #3
COC #	C40-1115	C40-1116	C40-1146	C40-1147	C40-1180	C40-1181
pH (SU)	6.8	6.9	7.1	6.9	7.2	7.2
Temperature (°C)	10.6	9.7	8.7	9.2	4.8	7.6
Dissolved Oxygen (mg/L)	11.6	11.9	9.7	9.9	12.4	12.1
Conductivity (µmhos)	1,250	168	1,092	121	1,798	125
Salinity (ppt)	<1	<1	< 1	< 1	<1	<1
TRC - DPD (mg/L)	0.022	0.016	0.013	0.009	0.008	0.014
TRC - Amperometric (mg/L)	N/A	N/A	N/A	N/A	N/A	N/A
Hardness (mg/L as $CaCO_3$)	86	22	82	18	82	16
Alkalinity (mg/l as $CaCO_3$)	110	15	105	10	105	10
Tech Initials	PD/CH	PD/CH	CW	CW	KO	KO

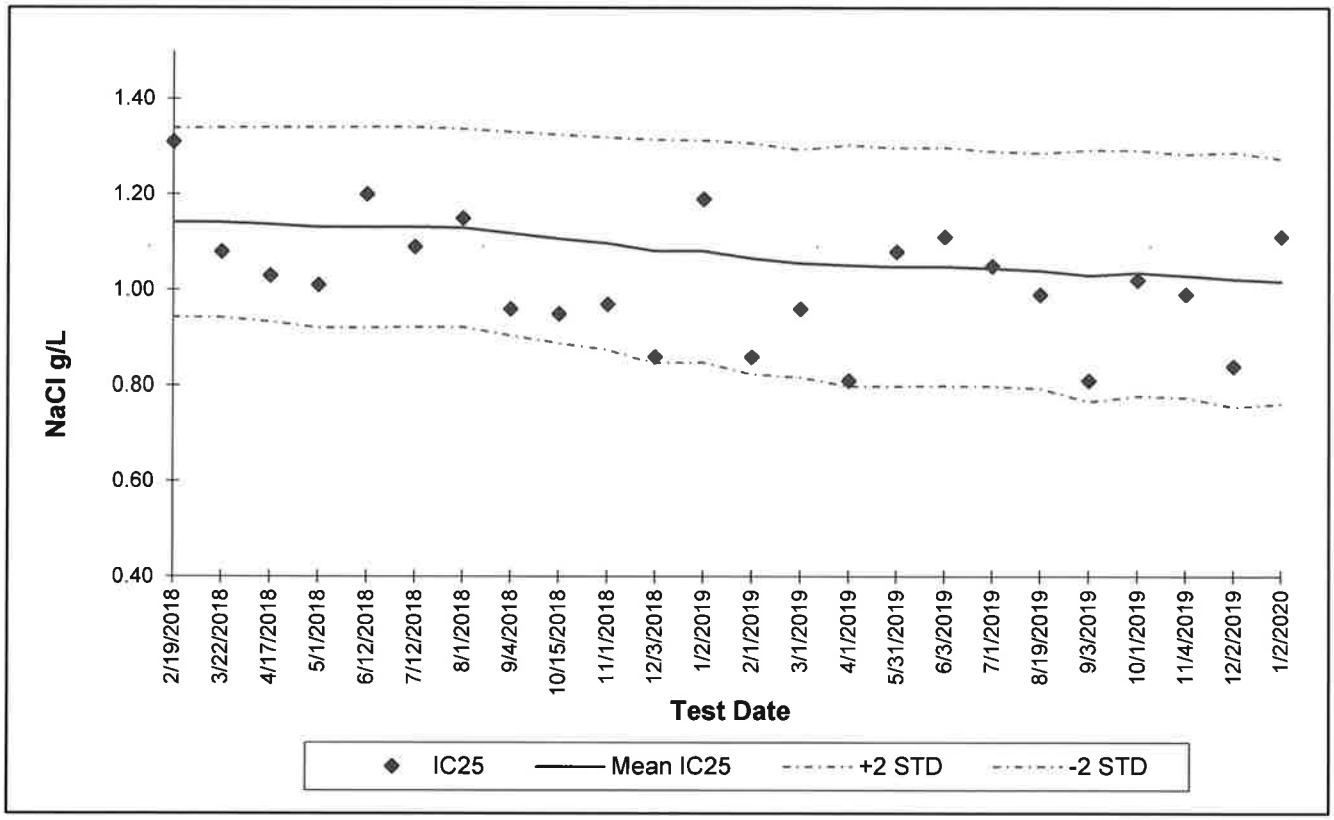
NOTE: NA = NOT APPLICABLE

Data Reviewed By: _____ Date Reviewed: 1/29/20

REFERENCE TOXICANT CHARTS

New England Bioassay

Reference Toxicant Data: Sodium chloride (NaCl) *Ceriodaphnia dubia* Chronic Reproduction IC_{25}



Test ID	Date	IC_{25}	Mean IC_{25}	STD	-2STD	+2STD	Avg. CV	Repro PMSD (%)	Avg. PMSD (%)
18-271	2/19/2018	1.31	1.14	0.10	0.94	1.34	0.09	22.90	16.56
18-416	3/22/2018	1.08	1.14	0.10	0.94	1.34	0.09	17.59	16.88
18-553	4/17/2018	1.03	1.14	0.10	0.93	1.34	0.09	38.54	17.77
18-607	5/1/2018	1.01	1.13	0.10	0.92	1.34	0.09	24.65	18.25
18-816	6/12/2018	1.20	1.13	0.11	0.92	1.34	0.09	46.97	19.59
18-996	7/12/2018	1.09	1.13	0.10	0.92	1.34	0.09	11.41	19.70
18-1103	8/1/2018	1.15	1.13	0.10	0.92	1.34	0.09	17.23	19.67
18-1315	9/4/2018	0.96	1.12	0.11	0.91	1.33	0.10	22.12	20.09
18-1577	10/15/2018	0.95	1.11	0.11	0.89	1.33	0.10	24.32	20.64
18-1625	11/1/2018	0.97	1.10	0.11	0.88	1.32	0.10	31.57	21.34
18-1756	12/3/2018	0.86	1.08	0.12	0.85	1.32	0.11	15.77	21.00
19-8	1/2/2019	1.19	1.08	0.12	0.85	1.31	0.11	40.72	21.30
19-177	2/1/2019	0.86	1.07	0.12	0.82	1.31	0.11	18.71	21.63
19-265	3/1/2019	0.96	1.06	0.12	0.82	1.29	0.11	19.84	22.13
19-403	4/1/2019	0.81	1.05	0.13	0.80	1.30	0.12	10.09	21.85
19-674	5/31/2019	1.08	1.05	0.12	0.80	1.30	0.12	15.59	21.93
19-688	6/3/2019	1.11	1.05	0.12	0.80	1.30	0.12	15.24	22.23
19-926	7/1/2019	1.05	1.04	0.12	0.80	1.29	0.12	12.60	22.23
19-1154	8/19/2019	0.99	1.04	0.12	0.79	1.29	0.12	24.17	22.24
19-1226	9/3/2019	0.81	1.03	0.13	0.77	1.29	0.13	19.49	21.64
19-1396	10/1/2019	1.02	1.04	0.13	0.78	1.29	0.12	18.01	21.38
19-1560	11/4/2019	0.99	1.03	0.13	0.77	1.28	0.12	14.03	21.13
19-1696	12/2/2019	0.84	1.02	0.13	0.76	1.29	0.13	25.84	21.59
20-2	1/2/2020	1.11	1.02	0.13	0.76	1.27	0.13	24.34	22.16

National 75th Percentile and 90th Percentile CV Averages for Ceriodaphnia Reproduction IC25 (EPA 833-R-00-003): 0.45 - 0.62
PMSD Upper and Lower Bounds for Ceriodaphnia Reproduction (EPA-821-R-02-013): 13% - 47%

Results:

Sample: Effluent Day 1
0A13003-01 (Water)

General Chemistry

	Result	Reporting Limit	Units	Date Analyzed
Alkalinity as CaCO3	**112**	2	mg/L	01/17/20
Ammonia	**18.2**	0.5	mg/L	01/20/20
pH	**7.2**	0.1	SU	01/13/20 16:45
Specific Conductance	**1180**	2	uS/cm	01/16/20
Total Dissolved Solids	**492**	10	mg/L	01/14/20
Total Organic Carbon	**6.6**	0.2	mg/L	01/17/20
Total solids (TS)	**580**	10	mg/L	01/14/20
Total Suspended Solids	**6**	2	mg/L	01/14/20

Total Metals

	Result	Reporting Limit	Units	Date Analyzed
Calcium	**28.1**	0.05	mg/L	01/16/20
Magnesium	**4.60**	0.05	mg/L	01/16/20
Aluminum	**0.020**	0.001	mg/l	01/14/20
Cadmium	ND	0.0001	mg/L	01/14/20
Copper	**0.004**	0.001	mg/l	01/14/20
Nickel	**0.003**	0.001	mg/l	01/14/20
Lead	**0.0003**	0.0001	mg/L	01/14/20
Zinc	**0.045**	0.001	mg/l	01/14/20
Total Hardness	**89.1**	0.125	mg/L	01/16/20

Sample: Merrimack River Day 1
0A13003-02 (Water)

General Chemistry

	Result	Reporting Limit	Units	Date Analyzed
Alkalinity as CaCO3	**10**	2	mg/L	01/17/20
Ammonia	**0.1**	0.1	mg/L	01/20/20
pH	**6.7**	0.1	SU	01/13/20 16:45
Specific Conductance	**161**	2	uS/cm	01/16/20
Total Dissolved Solids	**84**	10	mg/L	01/14/20
Total Organic Carbon	**3.2**	0.2	mg/L	01/17/20
Total solids (TS)	**108**	10	mg/L	01/14/20
Total Suspended Solids	**4**	2	mg/L	01/14/20

Sample: Merrimack River Day 1 (Continued)
0A13003-02 (Water)

Total Metals

	Result	Reporting Limit	Units	Date Analyzed
Calcium	**6.20**	0.05	mg/L	01/16/20
Magnesium	**1.19**	0.05	mg/L	01/16/20
Aluminum	**0.113**	0.001	mg/l	01/14/20
Cadmium	ND	0.0001	mg/L	01/14/20
Copper	**0.001**	0.001	mg/l	01/14/20
Nickel	ND	0.001	mg/l	01/14/20
Lead	**0.0005**	0.0001	mg/L	01/14/20
Zinc	**0.006**	0.001	mg/l	01/14/20
Total Hardness	**20.4**	0.125	mg/L	01/16/20

NEW ENGLAND BIOASSAY CHAIN-OF-CUSTODY

Sample Set #1

EFFLUENT

Sampler: JIN BOK MCGOWAN
Title: CHEMIST
Facility: Lowell Regional Wastewater Utilities

Sampling Method: X **Composite**
Sample ID:
Start Date: 1-12-2020 Time: 7:00 Am
End Date: 1-13-2020 Time: 7:00 Am

Sampling Method: _____ **Grab** (for pH and TRC only_____)
Date Collected:
Time Collected:

Sample Type:
_____ Prechlorinated
X Dechlorinated
_____ Unchlorinated
_____ Chlorinated

RECEIVING WATER

Sampler: Aaron FOX
Title: Ops Supervisor
Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Grab
Sample ID: Merrimack River
Date Collected: 1-13-2020
Time Collected: 8:00 Am

Received ON ICE

Effluent Sampling Location and Procedures: Plant outfall after dechlorination. 24 hr. composite.

Receiving Water Sampling Location and Procedures: Merrimack River upstream of the plant discharge at the Hunts Fall Bridge, (Rt.38)

Requested Analysis: X Chronic and modified acute

Sample Shipment

Method of Shipment: New England Testing Labs

Relinquished By:	Date: 1-13-2020	Time:	
Received By:	Date: 1.13.20	Time: 1155	
Relinquished By:	Date: 1.13.20	Time: 1420	
Received By:	Date: 1.13.20	Time: 1420	
Relinquished By:	Date: 1.13.20	Time: 1510	
Received By:	Date: 1-13-20	Time: 1510	

FOR NEB USE ONLY

*** Please return all ice packs NEB has provided to insure accurate temperature upon receipt to the NEB laboratory ***

Temperature of Effluent Upon Receipt at Lab: 10.6 °C
Temperature of Receiving Water Upon Receipt at Lab: 9.7 °C

Effluent COC# C40-1115
Receiving Water COC# C40-1116

IF THIS COOLER IS MISPLACED OR THE LABEL IS LOST, PLEASE SHIP TO:
KIM WILLS, NEW ENGLAND BIOASSAY, 77 BATSON DRIVE, MANCHESTER CT 06042

NEW ENGLAND BIOASSAY CHAIN-OF-CUSTODY

Sample Set #2

EFFLUENT

Sampler: JIN-BOIC MCGOWAN
Title: CHEMIST
Facility: Lowell Regional Wastewater Utilities

Sampling Method: X **Composite**
Sample ID:
Start Date: 1-14-2020 Time: 7:00
End Date: 1-15-2020 Time: 7:00

Sampling Method: _____ **Grab** (for pH and TRC only_____)
Date Collected:
Time Collected:

Sample Type:
_____ Prechlorinated
X Dechlorinated
_____ Unchlorinated
_____ Chlorinated

RECEIVING WATER

Sampler: Aara Fox
Title: ops. Superint.
Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Grab
Sample ID: Merrimack River
Date Collected: 1-15-2020
Time Collected: 8:00 Am

Received ON ICE

Effluent Sampling Location and Procedures: Plant outfall after dechlorination. 24 hr. composite.

Receiving Water Sampling Location and Procedures: Merrimack River upstream of the plant discharge at the Hunts Fall Bridge, (Rt.38)

Requested Analysis: X Chronic and modified acute

Sample Shipment

Method of Shipment: New England Testing Labs

Relinquished By:	Date: 1-15-20	Time: 12:30
Received By:	Date: 1.15.20	Time: 1230
Relinquished By:	Date: 1.15.20	Time: 1440
Received By:	Date: 1-15-20	Time: 2:40
Relinquished By:	Date: 1/15/20	Time: 3:25
Received By:	Date: 1/15/20	Time: 1525

FOR NEB USE ONLY

*** Please return all ice packs NEB has provided to insure accurate temperature upon receipt to the NEB laboratory ***

Temperature of Effluent Upon Receipt at Lab: 8.7 °C
Temperature of Receiving Water Upon Receipt at Lab: 9.2 °C

Effluent COC# C40-1146
Receiving Water COC# C40-1147

IF THIS COOLER IS MISPLACED OR THE LABEL IS LOST, PLEASE SHIP TO:
KIM WILLS, NEW ENGLAND BIOASSAY, 77 BATSON DRIVE, MANCHESTER CT 06042

NEW ENGLAND BIOASSAY CHAIN-OF-CUSTODY

Sample Set #3

EFFLUENT

Sampler: JIN BOK MOON
Title: CHEMIST
Facility: Lowell Regional Wastewater Utilities

Sampling Method: X **Composite**
Sample ID:
Start Date: 1-16-20 Time: 7:00
End Date: 1-17-20 Time: 7:00

Sampling Method: _____ **Grab** (for pH and TRC only_____)
Date Collected:
Time Collected:

RECEIVING WATER

Sampler: Aaron Fox
Title: Ops Supv
Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Grab
Sample ID: Merrimack River
Date Collected: 1-17-2020
Time Collected: 9:00 AM

Sample Type:
_____ Prechlorinated
X Dechlorinated
_____ Unchlorinated
_____ Chlorinated

Effluent Sampling Location and Procedures: Plant outfall after dechlorination. 24 hr. composite.

Receiving Water Sampling Location and Procedures: Merrimack River upstream of the plant discharge at the Hunts Fall Bridge, (Rt.38)

Requested Analysis: X Chronic and modified acute

Received ON ICE

Sample Shipment

Method of Shipment: New England Testing Labs

Relinquished By:	Date: 1-17-2020	Time: 10:30 AM
Received By:	Date: 1/17/2020	Time: 1070
Relinquished By:	Date: 1/17/2020	Time: 1315
Received By:	Date: 1/17/2020	Time: 1315
Relinquished By:	Date: 1/17/2020	Time: 14:05
Received By:	Date: 1/17/20	Time: 1422

FOR NEB USE ONLY

*** Please return all ice packs NEB has provided to insure accurate temperature upon receipt to the NEB laboratory ***

Temperature of Effluent Upon Receipt at Lab: 4.8 °C
Temperature of Receiving Water Upon Receipt at Lab: 7.6 °C

Effluent COC# C40-1180
Receiving Water COC# C40-1181

IF THIS COOLER IS MISPLACED OR THE LABEL IS LOST, PLEASE SHIP TO:
KIM WILLS, NEW ENGLAND BIOASSAY, 77 BATSON DRIVE, MANCHESTER CT 06042